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A BIOLOGICAL EVALUATION OF PINE MORTALITY AT TWO SITES IN GARNER VALLEY, SAN JACINTO RANGER DISTRICT, SAN BERNARDINO NATIONAL FOREST

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ABSTRACT

Pine mortality was evaluated at two locations in Garner Valley, San Jacinto Ranger District. Heterobasidion annosum (Fomes annosus), pine engravers, Ips spp., and the California flatheaded borer, Melanophila californica, were found to be causing damage. Trees were predisposed to insect attack by moisture stress, stocking above desired levels and annosus root disease. Present mortality is only the latest cycle of a recurring problem.

INTRODUCTION

On November 1, 1988, we accompanied Ernest Del Rio, silviculturist, and Kathy Valenzuela, resource officer, to Garner Valley on the San Jacinto Ranger District, San Bernardino National Forest in order to observe current pine mortality. Two areas were observed -- one east of Herkey Creek Campground, Apple Canyon, and one north of Kenworthy Station, Quinn Flat. These are in the same general area where Schultz and Kliejunas (1982) evaluated pine mortality in 1981.

OBSERVATIONS

The Apple Canyon site is a mosaic of open spaces interlaced with irregular strips and patches of 60-80 ft. Jeffrey pine -- the only tree species present

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in the immediate vicinity. Scattered within the open spaces are a few pines, mostly dead or dying, and stumps separated by distances up to 2.5 chains. A few seedlings from a 1982 planting are present and all seemed outwardly healthy. About 75 trees per acre would be enough for replanting the area. Across the paved road to the northeast is an area of much greater stocking and only one nearby opening with two dead pines.

The location does not appear to be an oak site, at least not black oak, for oaks are not present. Vegetation in general is sparse and bare soil is common amoung the small nonwoody plants. Gophers are sufficiently abundant to be a problem upon replanting.

Examination of dead and dying trees revealed only attacks by the California flatheaded borer, Melanophila californica. It is probable that pine engravers, Ips spp., had attacked the tops given the observations made at other locations on the district.

The stand on Quinn Flat is located on a bench of decomposed granite along the San Jacinto River, which is an intermittent stream above ground. All trees are Jeffrey pine 80-90 ft in height and 80-90 years old. The openings in the stand are not similar to those of Apple Canyon, but are of more recent origin. Pitch-streaming occurred along the bole within the crowns of some green Jeffrey pine. Dead trees are 16-22 inches dbh, and the largest beetle killed group measured 140 sq. ft. BA with a centered 20-factor prism.

Removal of bark from standing dead trees and nearby felled and bucked material revealed that the California flatheaded borer and pine engravers were the agents of mortality. Signs and symptoms of annosus root disease were not found at this particular site, but the disease was commonly found on Quinn Flat by Schultz and Kliejunas (1982).

DISCUSSION

The problem of pine mortality in Garner Valley was evaluated seven years ago (Schultz and Kliejunas 1982). Mortality from bark beetles and flatheaded borers was widespread at the time. Recurrence of mortality on the district can be traced back several decades to the 1950's (Downing 1954, Hall 1959). This is not surprising given overstocking and the widespread occurrence of annosus root disease. Mortality can be expected to continue in Garner Valley, and the situation may be further complicated by a possible decline in the water table along the San Jacinto River from recurring periods of drought and domestic use as development gradually increases. The return of normal precipiation levels would help to reduce mortality levels to "normal or background" levels. However, recurring mortality indicates that this level may be historically higher than that expected elsewhere on the district.

Management alternatives given by Schultz and Kliejunas (1982) generally apply to the sites observed and these are given in the following section. Not all the problems observed in 1981, such as dwarf mistletoe, were observed at Apple Canyon and Quinn Flat. However, all are common somewhere in the Garner Valley.

Management of the Apple Canyon site is a vexing problem. It is not an oak site and whether oaks or other nonhosts of annosus root disease could be induced to

thrive there is problematical. The fungal pathogen can remain viable in infected roots and stumps for several decades and this precludes maintaining host species within disease centers, and rotation and aesthetic goals will not be fulfilled.

No means of eradicating this root disease from an infection center are known, and pines will continue to die along the edges of centers as long as their roots come into contact with material containing the pathogen. Pine regeneration as a result of natural seeding and good moisture years will help maintain the pathogen within centers. These trees will not have a long life span because of the combination of root disease, insects and recurring moisture stress.

Removal of stumps and large roots by heavy equipment is being tested for other root diseases at sites in western North America. The objective is to shorten the time period during which the pathogen is viable at the site of treatment. The Apple Canyon site is flat and easily accessible by paved road and might make a good site for testing such a treatment for suppression of annosus root disease under conditions characteristic to southern California forests.

MANAGEMENT ALTERNATIVES

The following alternatives have been only slightly modified from the report by Schultz and Kliejunas (1982). Although western dwarf mistletoe (Arceuthobium campylopodium) was not seen in the two stands observed, it is present in the Garner Valley and is therefore included.

1. Do Nothing. Tree mortality levels will remain high until precipitation returns to normal. Experience and previous reports and records in southern California indicate that the level of tree mortality increases greatly during periods of low rainfall and accompanying high moisture stress. Trees under additional stress from root disease and dwarf mistletoe will die first.

Mortality will return to lower levels after precipitation returns to normal, but existing stand conditions will cause "background" level mortality greater than that which would occur in intensively managed stands. Mortality due to pine engravers will probably decrease within a few months after precipitation increases. The California flatheaded borer will continue to breed in the boles of trees top-killed by engraver beetles and in trees stressed or predisposed to attack by root diseases, overstocking and dwarf mistletoe. Pines which regain full vigor after moisture stress is alleviated should be able to overgrow and kill any small flatheaded larvae present in their cambial area.

2. Salvage Dead Trees. This option will remove dead trees to enhance the scenic value along roads, realize some economic value from the killed timber, and/or provide firewood.

Under this option mortality can be expected to continue, necessitating repeated salvage. Additionally, disturbance in the moisture-stressed stands might increase the susceptibility of trees to insect attack. Any green pine slash laid on the ground before mid-July would tend to increase or maintain the pine engraver populations. A further consideration is that the major method of disposing of the dead trees would be as fuelwood to local residents. It is

possible that dead trees could contain pine engraver broods which could cause tree mortality after emerging in residential areas. Also, some of the top-killed trees still have green butts which have the potential to attract a considerable number of engraver beetles. If this material is stacked against or adjacent to a backyard pine, the beetles attracted to it may be numerous enough to overcome the nearby healthy pine.

3. Integrate Pest Management Considerations with Stand Prescriptions. Stand treatments will not end the current episode of high mortality, but will aid in lowering the "background" rate of mortality and minimizing losses during future periods of moisture stress. The integration of pest management considerations with stand prescriptions should bring about and maintain a low level of tree mortality during years of average or above-average rainfall, and prevent widespread tree mortality during periods of drought. However, some tree mortality will continue, especially in existing root disease centers and in stands with trees that are heavily infected with dwarf mistletoe or otherwise at high risk to insect attack.

Specific components of an integrated pest management system that appear appropriate include the following:

a. Borax Stump Treatment. Fomes annosus was involved in a substantial proportion of the mortality observed. Where present, it plays a key role in predisposing trees to successful insect attack. New infections can be prevented by applying borax to freshly cut stumps of live or recently killed trees. Treatment of all freshly cut conifer stumps with borax is required in and near recreation sites (FSM R-5 Supp. 164, FSM 2303.14 9/86).

The Apple Canyon site is replete with infection centers, but even here it would be adviseable to treat stumps because of the adjacent recreation area. Certainly all stumps should be treated in the less infected area east of the paved road.

b. Thinning. Thinning is an effective stand treatment for prevention of bark beetle-caused mortality. The beneficial effect of thinning is especially apparent during periods of stress, such as periods of below-normal precipitation. Thinning can also be an important tool for minimizing the effects of dwarf mistletoe. The pathogen becomes especially damaging in stands that stagnate. Spacing control allows the trees to grow proportionally faster in height than the parasite moves upward in the tree. If the thinning is done early when the stems are small, the likelihood of annosus infection of the stumps will be decreased.

Basal area thinning guidelines are not available for specific pests in southern California. However, it is reasonable to expect that a level of thinning that results in the maintenance of good radial growth, height growth and a full crown will make the trees resistant to insect attack and killing. The basal area of 140 measured at Quinn Flat is too high; a stocking in the range of 90-100 sq. ft. would be more appropriate and render the stand less susceptible to moisture stress and attack by flatheaded borers and bark beetles.

c. Sanitation. Thinning provides an opportunity to remove trees that are infected by pathogens or that are likely to be attacked and killed by insects.

Sanitation is also a useful tool for preventing future mortality from dwarf mistletoe.

d. Mixed Stands. No feasible means of eradication F. annosus from an infection center are known, so centers of mortality can be expected to enlarge indefinitely as roots of susceptible trees become infected at the margins of the center.

The effects of the fungus can be minimized, however, through the use of nonhost species. Most hardwoods are not susceptible to the disease, and may be successfully grown in disease centers located in suitable habitat.

The encouragement of mixed stands is also a good dwarf mistletoe management technique. Given the narrow host range of most of the dwarf mistletoe species, it is frequently possible to encourage non-host conifers when thinning or planting. The western dwarf mistletoe present on Coulter and Jeffrey pines can also infect ponderosa and knobcone pine, but other conifers and hardwoods are immune.

e. Overstory Removal. Dwarf mistletoe-infected overstory trees present a special threat to susceptible trees growing nearby. Dwarf mistletoe seeds are forcibly discharged and land in the crowns of understory trees. Infections in the upper crown are especially damaging to the tree. It may be beneficial in the long run to remove selected overstory trees in order to prolong the life of the future stand. This is best done on an individual-tree or small-group basis which fits well into Forest Plans to manage by group selection.

Integrated pest management refers to the integration of specific treatments for reducing and/or preventing pest damage with on-going silvicultural prescriptions. The available options may or may not be appropriate in given situations. The specific pest and forest management prescriptions are written by the forest manager in light of the needs of the stand, and the objective for the stand.

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